now hoists its modest banner, believing that the administration of Secretary Lane under President Wilson affords a peculiarly favorable moment for the initiation of cooperative efforts of which the justification may be rational, rather than merely traditional. Obviously, those patent reform efforts which the National Research Council is understood to have deferred (in so far as they have been deferred) only by unavoidable necessity can reach the largest effects only as a result of a very comprehensive movement—in regard to which all interested and competent parties should be heard. And (if every other special qualification be disputed) who so well as examiners and assistant examiners can tell how distressing a thing it is for men charged with exhaustive research, and with judicial responsibilities therein, to be obliged to act hastily and superficially upon matters involving the largest public and private interests?

Lightly tossing a very broad challenge, one might ask—"Do not the prospects of democratic government, in competition with more centralized forms, ultimately depend on the capacity to initiate, to organize, to present and to utilize criticism. Within a republic, does not the duty of utterance devolve upon all who possess special information? But we now press only the more specific question: Is it not reasonably possible that manufacturers, investors, practitioners, jurists, publicists, scientists and engineers, as well as inventors of every field and grade, conferring under the coordinating influence of so disinterested and competent a body as the National Research Council, will, from this time forward, work more and more effectively to insure the *prompt* grant of *proper* patents—only; and to make the genuine inventor, the investor and the public alike really *secure* by a very clear and a very just definition of rights? Upon the determination of this one fundamental question we do urge an early test—before still more complete failure of the patent system shall bring it into utter contempt—even though in the execution of such a test we, the "proponents," may be able to undertake only a very subordinate part.

At least, we of the Patent Office Society hope we simplify the situation by inviting—for possible publication, and by no means in a spirit of challenge—criticism of any phase or feature of the present patent system. May we not soon hear again from yourselves?

Sincerely and fraternally,

BERT RUSSELL,
Secretary, Patent Office Society

SPECIAL ARTICLES

POLARIZATION IN CASE OF MOVING ELECTRODES

IN connection with other work, I incidentally came upon the following phenomenon which I have not found clearly stated anywhere; though from the enormous amount of work done on polarization, I can hardly suppose it to be new. In part it might be surmised from Hittorf's researches on the migrations of the ions.

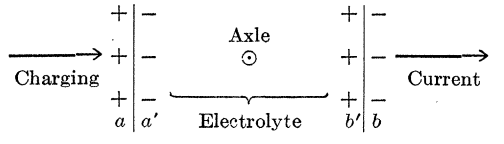
In order to keep the resistance of the circuit constant, bright zinc electrodes, facing each other diametrically, and set tangentially to the arc of motion, were rotated around a vertical axis midway between, in an electrolyte of dilute brine. A small electromotor and pulleys, collector rings and brushes made up the remainder of the apparatus. Special care was taken that all parts of the circuit, except the free zinc surfaces to be tested, were thoroughly insulated; for the effects produced by splashing of liquid may be misleading and the brush contacts must be good.

The electrodes at practically the same potential were now charged by a single storage cell for 30 sec., the charging current being .16 am. for electrodes of about 26 sq. cm. each. On breaking, the polarization was naturally enormous (needle off scale); but it vanished rapidly in the well-known way, being counter to the charging current. When this polarization had fallen to about -0.010 volt, the electrodes were rotated. At once the polarization changed sign and was again enormous (needle off scale) and in its turn fell off in the usual way. When it had fallen to $+0.004$ volt the electrodes were stopped, leaving $+0.003$ volt, about.[1] Subsequent motion increased the electromotive force slightly in the direction of the charging current. In other words this second or residual polarization observed during the motion of the electrodes is astonishingly strong and *in the direction of the charging current.* To test this further, the latter was reversed many times, always reversing the phenomena as a whole, while in character they remained the

[1] Different experiments give different data, without changing the character of the values.

same. The electrodes must be bright, as otherwise the phenomenon becomes very complicated. Furthermore the original polarization must often surpass a certain value if the residual polarization is to be contrary in sign; and there are other differences in detail for which there is no room here. Thus the rotational effect may proceed gradually to a maximum; an electromotive force zero may imply a very large residual polarization appearing on motion. The charging of moving electrodes is an interesting case; etc.

To elucidate this phenomenon, it suffices here to assume the occurrence of paired double layers $a\ a'$ and $b'\ b$, one double layer at each electrode. One element, a', b', of each double layer is localized in the liquid and the other element a, b in the solid electrode, both of the double layers having the same direction; *i. e.*, being two condensers in series. Hence there are two interpenetrating electrostatic fields, one



$b'\ a'$ localized in the liquid and the other $a\ b$ in the electrodes. These fields are in a contrary direction and the liquid field must be very much stronger to correspond with the initial counter polarization. On rotating the electrodes, the field localized in the liquid $b'\ a'$ is set free and its ions dissipated. The field localized in the solid, $a\ b$, however, remains and this constitutes the residual polarization in the direction of the charging current. Both fields decay in the lapse of time in the usual way.

When rotation ceases a liquid field is reestablished, but usually, though not always, to a smaller degree. Eventually a probably discharges a' and b, b', one of the fields passing through zero first, so that the effect of rotation finally vanishes. I have met both with marked polarization which on rotation vanished, as well as with an apparent absence of polarization which on rotation became very marked.

To obtain moving electrodes as free from polarization disturbances at the contact with a liquid, it is therefore prudent to capture both fields; *i. e.*, to leave the electrodes entirely without interferences. This may be done by surrounding each with a porous cup, closed and completely filled with an electrolyte, the terminals passing out through an insulating tube. The electrodes should moreover be fixed rigidly to the cup. Again since zinc electrodes soon tarnish in brine but remain bright in concentrated zinc sulphate solution, the latter is a preferable electrolyte and the cups may be submerged in brine or any other solution.

I therefore constructed two cup electrodes of the kind in question and placed them in the rotational apparatus as before. The original potential difference of the zincs was about .4 millivolt. After keeping the circuit closed over night this fell off to below .05 millivolt, and could be eliminated by exchanging the cup electrodes. Rotation of the appartus, *i. e.*, an external current in the brine surrounding the cups, produced no appreciable effect. The electrodes were then charged with a current of .2 am. for 30 sec. The polarization remaining was now much less than above, throughout, beginning with about 5 millivolts which fell to .5 m.v. in 5 minutes and to .05 in a few hours. Rotation was ineffective through all stages of the decay. No doubt the simple electrode in which both the original and the residual polarizations have vanished would often suffice, but with greater uncertainty, because such electrodes can not be exchanged without danger as to modifying their value.

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